

Claims

[c1] What is claimed is:

1.A method of fabricating a polysilicon film by an excimer laser crystallization (ELC) process comprising following steps:

providing a substrate, the substrate surface defined with a first region, a second region surrounding the first region, and a third region;

forming an amorphous silicon film on the silicon substrate;

performing a first photo-etching process to remove parts of the amorphous silicon film in the third region to form an alignment mark in the third region;

forming a mask layer on the amorphous silicon film;

performing a second photo-etching process to remove the mask layer on the amorphous film in the first region;
and

performing the excimer laser crystallization process with an excimer laser to make the amorphous film in the first region crystallize to a polysilicon film.

[c2] 2.The method of claim 1 wherein the substrate further comprises a buffer layer and the amorphous silicon film

is formed on the surface of the buffer layer.

- [c3] 3.The method of claim 1 wherein the method further comprises a step of removing the mask layer after forming the polysilicon film.
- [c4] 4.The method of claim 1 wherein the polysilicon film functions as an active area of a thin film transistor.
- [c5] 5.The method of claim 1 wherein the alignment mark is used to increase the alignment ability of photo masks in latter processes.
- [c6] 6.The method of claim 1 wherein the mask layer comprises a silicon oxide layer, a silicon nitride layer, or a silicon-oxy nitride layer.
- [c7] 7.The method of claim 1 wherein the excimer layer crystallization process uses an excimer laser to irradiate the amorphous film to make the amorphous silicon film in the second region, which is covered with the mask layer, become completely melted and make the amorphous film in the first region, which is not covered with the mask layer, become partially melted, and grains are grown laterally toward the first region from the interface between the first region and the second region so as to form a polysilicon film in the first region.

- [c8] 8.The method of claim 1 wherein the excimer laser comprises a long pulse duration laser.
- [c9] 9.The method of claim 8 wherein the period of the long pulse duration laser is in a range of 150 to 250 ns.
- [c10] 10.The method of claim 1 wherein the method further comprises a step of forming a heat-retaining capping layer on the mask layer and the amorphous silicon layer before performing the excimer laser crystallization process to increase the size of the grains in the polysilicon film.
- [c11] 11.A method of forming a polysilicon film by an excimer laser crystallization process, the method comprising following steps:
providing a substrate, the substrate surface defined with a first region, a second region surrounding the first region, and a third region;
forming an amorphous silicon film on the substrate;
performing a first photo-etching process to remove parts of the amorphous silicon film in the third region to form an alignment mark in the third region;
forming a heat-retaining capping layer covering the amorphous silicon film and the substrate;
forming a mask layer on the heat-retaining capping layer;

performing a second photo-etching process to remove the mask layer in the first region; and
performing the excimer laser crystallization process with an excimer laser to make the amorphous film in the first region crystallize to a polysilicon film.

[c12] 12.The method of claim 11 wherein the substrate comprises a buffer layer and the amorphous silicon film is formed on the buffer layer.

[c13] 13.The method of claim 11 wherein the method further comprises a step of removing the mask layer and the heat-retaining capping layer after forming the polysilicon film.

[c14] 14.The method of claim 11 wherein the polysilicon film functions as an active area of a thin film transistor.

[c15] 15.The method of claim 11 wherein the alignment mark is used to increase the alignment ability of photo masks in latter processes.

[c16] 16.The method of claim 11 wherein the mask layer comprises a silicon oxide layer, a silicon nitride layer, or a silicon-oxy nitride layer.

[c17] 17.The method of claim 11 wherein the heat-retaining capping layer comprises a silicon oxide layer, a silicon

nitride layer, or a silicon-oxy nitride layer.

[c18] 18.The method of claim 11 wherein the excimer layer crystallization process uses an excimer laser to irradiate the amorphous film to make the amorphous silicon film in the second region, which is covered with the mask layer, become completely melted and make the amorphous film in the first region, which is not covered with the mask layer, become partially melted, and grains are grown laterally toward the first region from the interface between the first region and the second region so as to form a polysilicon film in the first region.

[c19] 19.The method of claim 11 wherein the excimer laser comprises a long pulse duration laser.

[c20] 20.The method of claim 19 wherein the period of the long pulse duration laser is in a range of 150 to 250 ns.